Environmental Asthma Triggers in Montana

Matthew R. Herington, JD, MPH,
CHES, CPH, AE-C

Indoor Asthma Triggers

Tobacco Smoke

- "Sufficient evidence of a causal relationship" between exposure to ETS and the exacerbation of asthma in sensitive individuals of preschool age
- "Limited or suggestive evidence of an association" was found to exist between ETS and the exacerbation of asthma in sensitive older children and adults
- 43 percent of 8th, 10th, and 12th grade students exposed to ETS in a room in the previous 30 days
- 33 percent of 8th, 10th, and 12th grade students exposed to ETS in a vehicle in the previous 30 days
- 16 percent of adults with asthma report someone smokes in the home; 12 percent of children

Current Use of Tobacco

- In Montana, 16.8 percent of adults are current smokers
- In the United States, 18 percent of adults current smokers
- 33 percent of high school students in Montana with current asthma used tobacco products in the last 30 days
- 20 percent of adults with asthma in Montana are current smokers

Particulate Matter

- Particles suspended in the air.
  - Pollen, bacteria, emissions from certain factories, motor vehicles, tobacco smoke, furry and feathered animals, fireplaces, wood stoves
    - Newer EPA-certified wood stoves can cut down on emissions significantly
      - 15 and 30 grams of smoke per hour; now two to seven grams of smoke per hour
- Woodstove changeout program in Libby
  - Average $PM_{2.5}$ levels dropped from 51.2 $\mu g/m^3$ to 15 $\mu g/m^3$
- 28 percent of adults with asthma use wood stoves or fireplaces to heat their home in Montana

Mold

- "Inadequate or insufficient evidence to determine whether or not an association exists" between fungi or molds and the exacerbation of asthma
- Relative humidity 30 and 50 percent in the indoor environment
- Relative humidity in Montana during the morning hours is approximately 75 percent
  - Relative humidity in the afternoon averages about 70 percent during the winter, less than 35 percent during the middle of the summer
- Increased respiratory symptoms in those children who live in damp homes
- 10.4 percent of Montana adults with asthma have seen mold in their home in the last 30 days

Dust Mites

- "Sufficient evidence of a causal relationship" between dust mite exposure and asthma exacerbations
  - "Sufficient evidence of a causal relationship" between dust mites and the development of asthma
- Microscopic arachnids that feed on small pieces of organic matter
- Carpet, upholstered furniture, bedding, fabric

Dust Mites

- Altitude
- Experiments conducted at less than 50 percent relative humidity
- Montana has a mean elevation of 3400 feet above sea level and is not particularly humid
- Studies conducted in similar climates reveal low levels of dust mite allergen, low levels of dust mites
- Sensitization to dust mites has been reported among asthma patients in Montana

Nitrogen Dioxide (NO_2)

- "Sufficient evidence of an association" between NO_2 (and other nitrogen oxides) and the exacerbation of asthma.
  - "at concentrations that may occur only when gas appliances are used in poorly ventilated kitchens"
- Brown-colored gas with a characteristic odor
- Formed during high-temperature combustion
  - Main source of indoor nitrogen dioxide (NO_2) is unvented gas appliances
  - Also, improperly vented furnaces and fireplaces
- In Montana, approximately 25 percent of people with asthma use gas for cooking
- Survey data also indicates that only four percent of adult Montanans with asthma use an unvented gas stove or fireplace

Furry and Feathered Pets

- "Sufficient evidence of a causal relationship" between exposure to cats and the exacerbation of asthma
- "Sufficient evidence of an association" for dogs
- "Limited or suggestive evidence of an association" for domestic birds
- Cat and dog allergens found in homes where no dog or cat is present
- Two-thirds of Montanans with asthma have indoor feathered or furry pets
- 40 percent of Montana children with asthma sleep with a family pet
- Over two-thirds of people with asthma in Montana have bedroom carpeting
  - Tends to trap pet allergen

Rodents

- "Inadequate or insufficient evidence to determine whether or not an association exists" between rodents and the exacerbation of asthma
- Chronic, daily exposure to rodent can contribute to the development of sensitization to rodents
- Deer mouse is particularly prevalent
- In Montana, about seven percent of adults with asthma and ten percent of children with asthma report they have seen rats or mice in their home during the previous 30 days

Cockroaches

- "Sufficient evidence of a causal relationship" between cockroaches and the exacerbation of asthma
- In the US, the two most common species are the German cockroach (*Blatella germanica)*, and the American cockroach (*Periplaneta americana*)
  - Cockroaches to which Americans are most commonly sensitized
- Cockroach allergen may be found in a home even though the cockroaches are not visible to the inhabitants
- Cockroaches are not common in Montana
  - Very few Montanans with asthma have reported seeing a cockroach in their home

Other

- Ozone
  - Ionizers associated with indoor air purifiers can produce O_3, potentially triggering asthma exacerbations.
    - Copy machines
- Volatile Organic Compounds
  - Volatile organic compounds are carbon containing chemicals that exist as free vapors or that are adsorbed onto particles present in the air
  - "Inadequate or insufficient evidence to determine whether or not an association exists" between VOCs and the exacerbation of asthma
  - "Limited or suggestive evidence of an association" between formaldehyde and the exacerbation of asthma
  - "Limited or suggestive evidence of an association" for "fragrances"

Outdoor Asthma Triggers

Cold Air

- Cold air and exercise
- Contributes to atmospheric inversions
- No published studies in Montana that demonstrates a linkage between inversions and asthma symptoms
  - Those people with asthma are at greater risk for exacerbations during these frequent inversion conditions

Wildfires

- Nitrogen oxides (NOx), particulate matter, and various volatile organic compounds
- Length of the average wildfire season in Montana has increased
  - Comparing the time period from 1970-1986 with 1987-2003, the average wildfire season has increased by 78 days
- Higher frequency of large wildfires and a longer average duration of individual wildfires in the western US
- Predicted to be the region of the US with the largest amount of wildfire activity 50 years from now

Pollen

- Tree, grass, and weed pollen
- Among deciduous trees, pollination occurs in the spring, the same time as leaf development
- Common sources of pollen in western Montana are pine, juniper, alder, birch, poplar, ash, and maple
- In a recent survey conducted among people with asthma in western Montana, greater than 50 percent of the respondents breathing difficulties as a result of exposure to airborne pollen in the spring
  - Twenty percent reported that they stayed indoors to avoid exposure to airborne pollen during the spring

Ozone (O_3)

- Ground-level ozone (O_3) is the primary component of photochemical smog
- Major outdoor sources of nitrogen oxides and hydrocarbons (and, indirectly, O_3) include automobiles, industrial processes, and power plant emissions
- In Montana, currently no nonattainment areas for O_3
  - Montana Department of Environmental Quality: ozone "is not currently a pollutant of concern in Montana."

Nitrogen Dioxide (NO_2)

- Automobiles are the largest source of NO_2 emissions nationally
  - Other common sources include: industry, power plants, forest fires
- Hospital admissions for asthma have been documented to rise with increased ambient NO_2 levels
- There are currently no areas in Montana that are designated as nonattainment for NO_2
  - Wildfires

Sulfur Dioxide (SO_2)

- A gas formed during the combustion of coal and petroleum
- Irritates the respiratory tract and eyes
  - Among people with asthma, SO_2 concentrations between .25 and .50 parts per million have been demonstrated to cause narrowing of the airways when individuals are exercising
- Two nonattainment areas: East Helena, Laurel area

Particulate Matter

- Sources
  - Manmade: manufacturing processes, vehicle emissions, mining
  - Natural: wildfires, volcanic ash, and various biological particles
- Among those with asthma, exposure to particulate matter in the outdoor environment has been linked to asthma exacerbations and decreased lung function
- Nonattainment areas for particulate matter
  - PM_{10}: Butte, Columbia Falls, Kalispell, Whitefish and vicinity, Lame Deer, Missoula, Polson, Ronan, Libby, and Thompson Falls and vicinity.
  - $PM_{2.5}$: Libby
- A study found that residential wood combustion from wood stoves constituted greater than 80 percent of the $PM_{2.5}$ in the Libby valley
  - Inversions

Work-related Asthma

- Asthma that is induced by inhalation exposures in the workplace
  - work-exacerbated asthma
  - occupational asthma
- 15-20 percent of asthma cases may be attributable to occupational exposures
- Greater than 250 biological and chemical agents have been linked to work-related asthma
  - cleaning products, rodents, and assorted pharmaceutical compounds
- More than half of the people with asthma in Montana may have asthma that is potentially work-related
  - 44 percent report their asthma is caused by their current job or a previous job
  - 35 percent report their asthma is aggravated by their current job or a previous job
  - 10 percent of respondents reported quitting or changing their job because it made their asthma worse

Key Research Needs

- Dust mites
- Indoor dampness
- Particulate matter
  - EPA-certified wood stoves
- Temperature inversions
- Wildfires
- Work-related asthma

Key Clinical Messages

- Focus on indoor asthma triggers
- Tobacco
- Moisture control
- EPR-3: "that clinicians advise patients to avoid, to the extent possible, exertion or exercise outside when levels of air pollution are high"
  - The "Today's Air" website is located at http://todaysair.mt.gov/
- Important that clinicians ask patients with asthma about possible occupational exposures

Key Public Policy Implications

- Tobacco
- Preparation for wildfire events
  - State and federal agencies, healthcare providers, the media, and people with asthma
- Ensuring clean air in Montana
  - Clean Air Act
  - EPA estimates that 1.7 million asthma exacerbations were prevented in 2010 alone as a result of the 1990 Clean Air Act amendments
  - Continuing to ensure adequate regulation of outdoor pollutants crucial to prevent asthma exacerbations as the population of both Montana and the US continues to expand
- A work-related asthma surveillance system is needed in Montana
  - SENSOR